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## (54) Coin handling apparatus

(57) A coin handling apparatus 200 comprises a first elongate part 12 and a second elongate part 14 which parts are configured for relative sliding movement and define an elongate coin passage 52 therebetween. The parts 12, 14 are provided with projections 60, 96 which are disposed in the coin passage. The projections are cooperable such that, in use, reciprocal sliding movement of one of said parts relative to the other said part causes coins C1, C3 to be transferred along the coin passage in a stepwise manner from an inlet 54 into a first coin receiving compartment 110(1) and from the first compartment to a second compartment 110(2). The apparatus is designed to remove coins one at a time from the bottom of a stack in an inlet 54 of part 12. The extent of the deflection of a projection may be used to determine coin thickness.

FIG.12

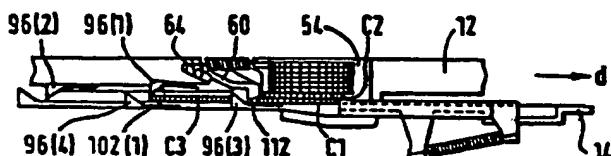
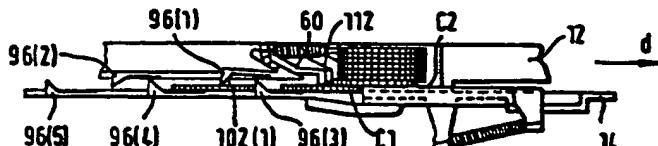
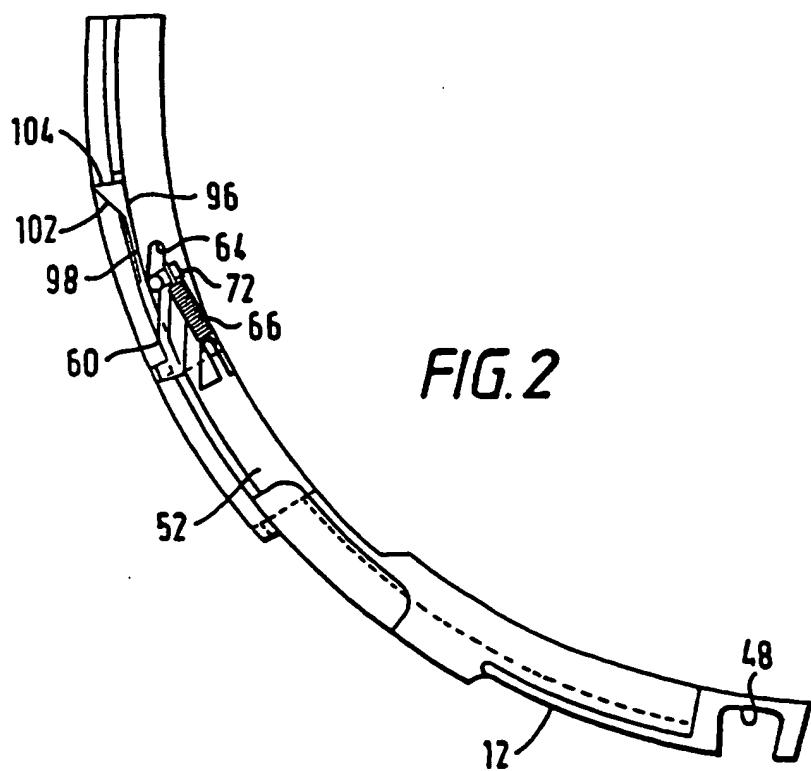
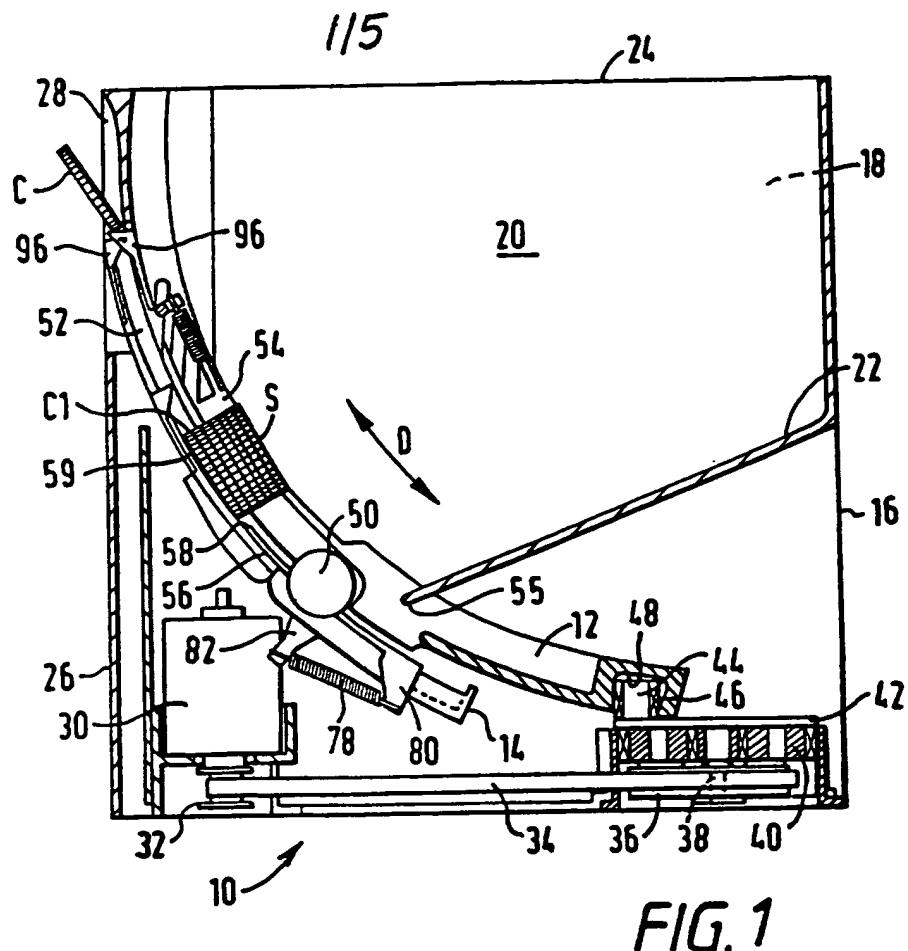
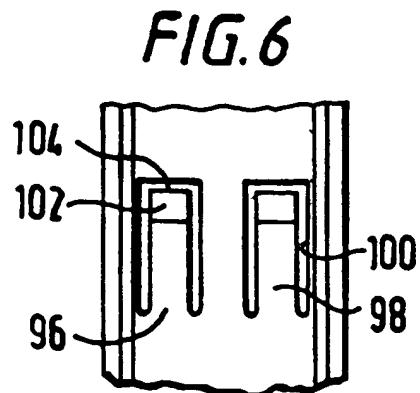
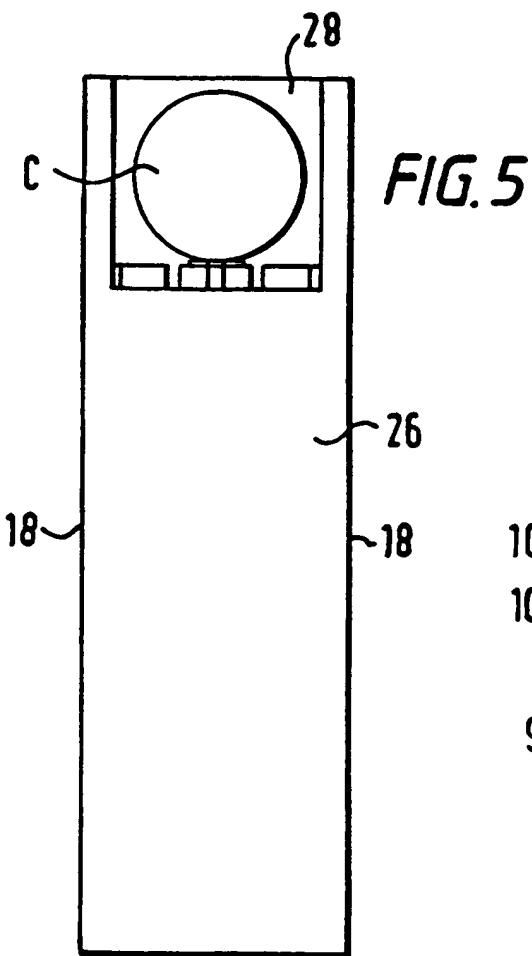
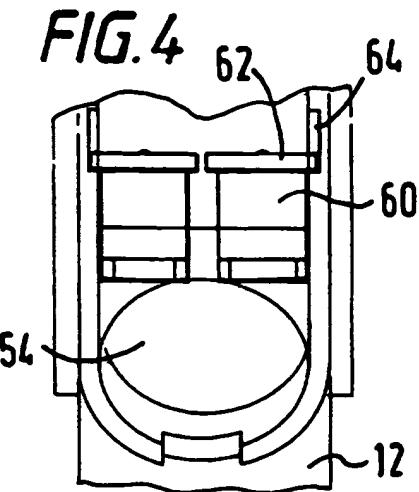
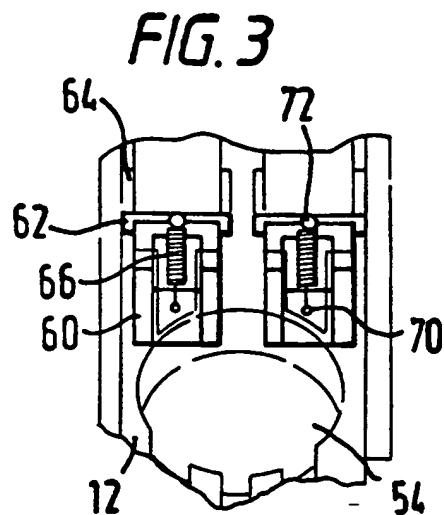


FIG.13

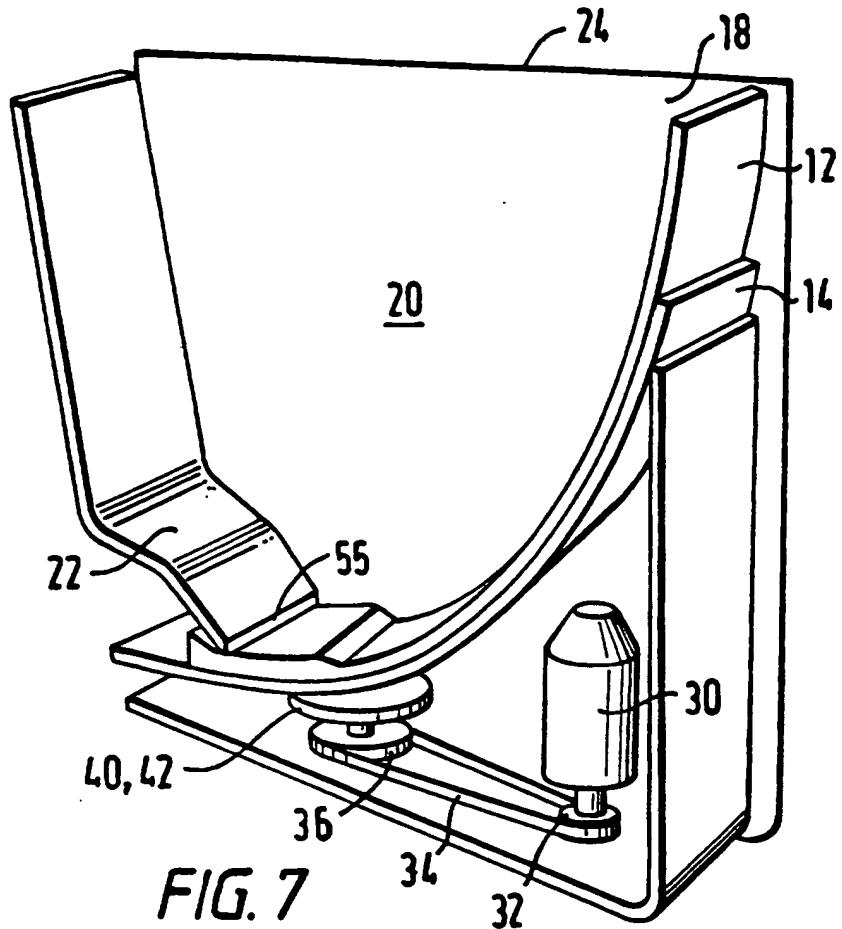


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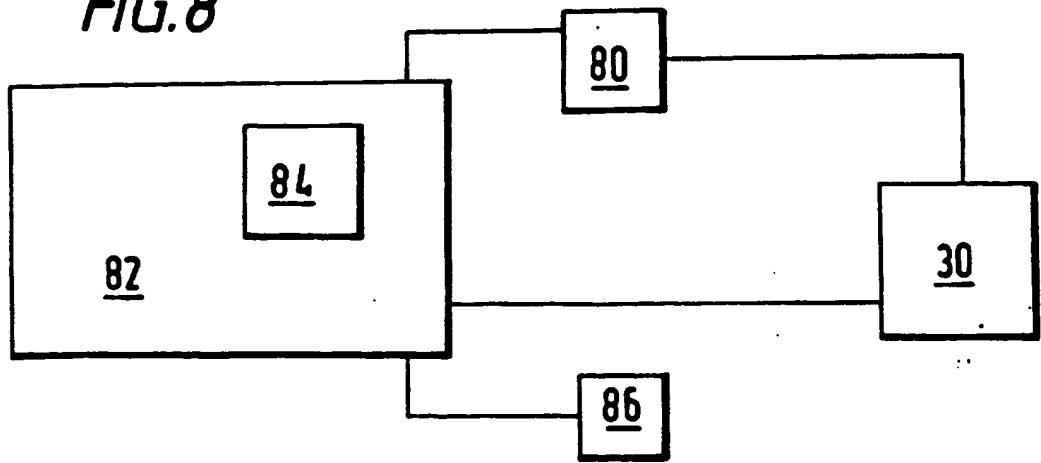




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**FIG. 8**



415

FIG. 9

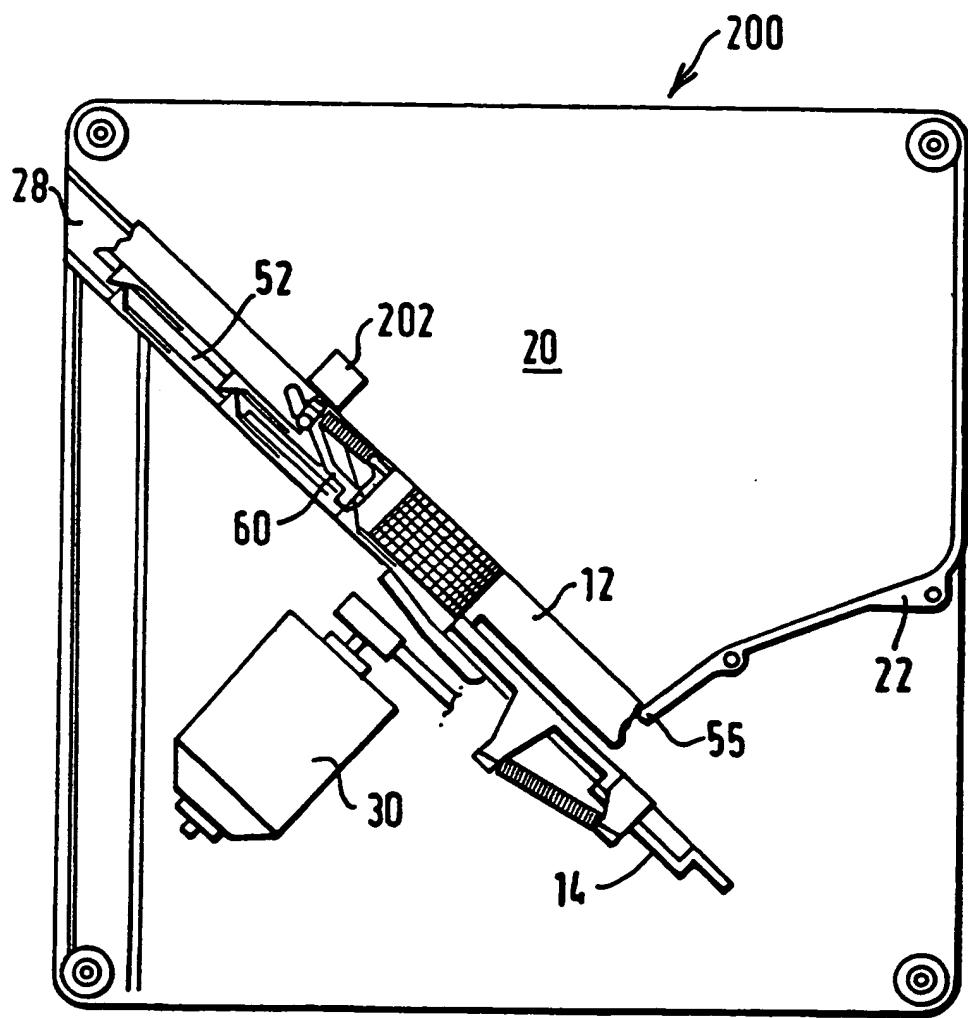


FIG.10

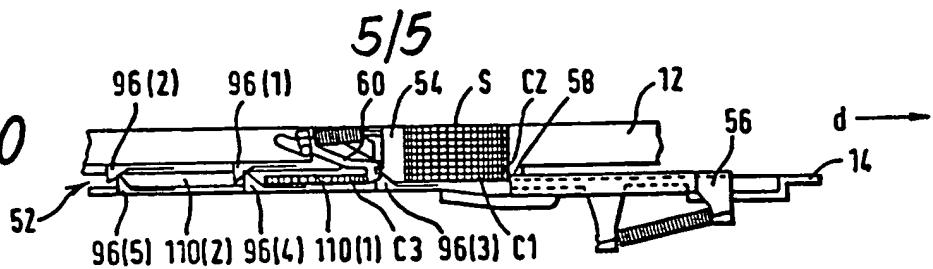


FIG.11

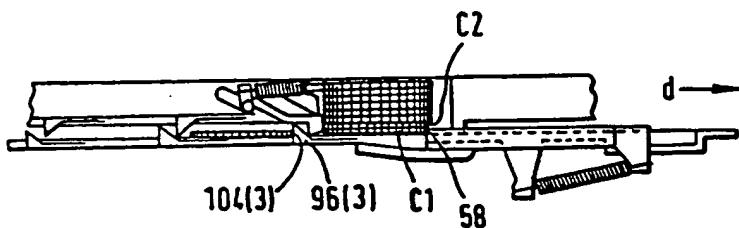


FIG.12

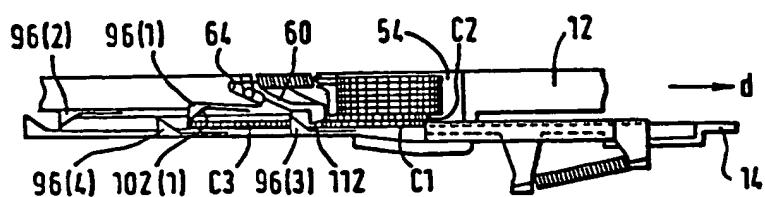


FIG.13

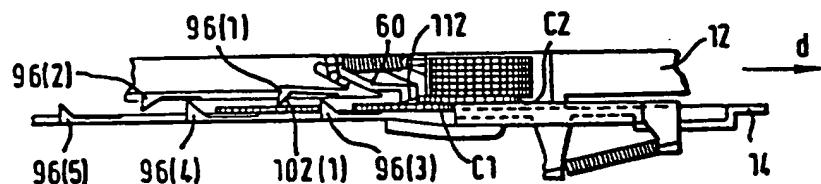


FIG.14

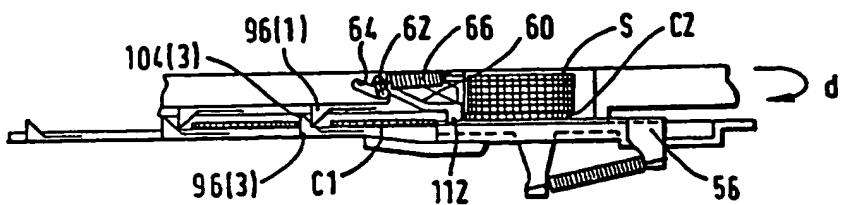


FIG.15

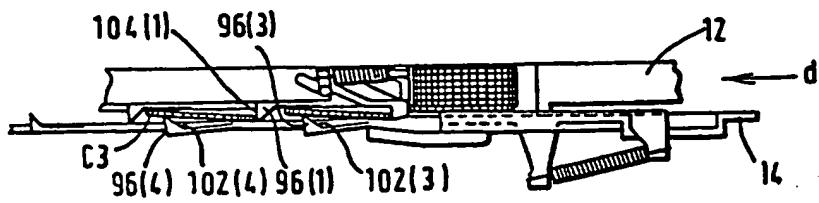
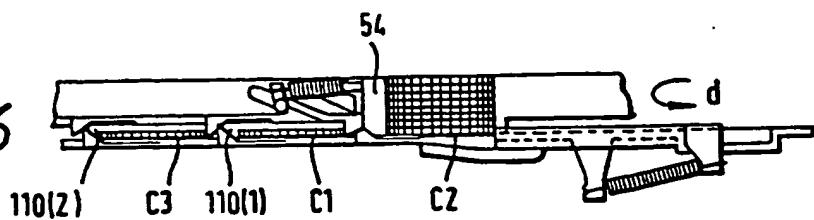


FIG.16



COIN HANDLING APPARATUS

The invention relates to coin handling apparatus.

In this document the term "coin" is employed to mean any coin (whether valid or counterfeit), token or 5 similar such disc-like object to be dispensed from vending machines, amusement or gaming machines, change giving machines or other machines from which coins, tokens or the like are to be dispensed.

10 The invention is particularly suitable for use in amusement or gaming machines for paying out winnings in the form of tokens or coins. In the description which follows, the invention will be described in connection with paying out coins from a gaming machine but it is to be understood that this is purely for 15 illustrative purposes and is not to be taken as limiting.

20 Coins to be paid out from a gaming machine may be stored in a hopper or in coin tubes which contain a column of coins. In the case where coin tubes are used, if the machine is to have an adequate payout capacity, tall coin tubes which may have a length in the region of 0.6 m have to be used with the result that the payout cup or tray has to be located towards 25 the bottom of the machine. Accordingly, the user of such a machine must suffer the inconvenience of

stooping to collect any winnings.

Coin hoppers have the advantage over coin tubes that they can be rapidly filled by simply pouring a bag of coins into the hopper. However, coin hoppers and the associated means for dispensing coins therefrom tend to be relatively large in size and usually the only area in a gaming machine in which there is sufficient space to house a coin hopper and provide access for filling the hopper is situated in the base region of the machine. Thus, unless apparatus is provided which can transfer coins from the coin hopper to a payout point located above it, the payout opening in the machine has to be situated in a lower portion thereof. Thus, as described above in relation to coin tubes, the user is required to stoop in order to collect any winnings.

EP-A-0080842 discloses a coin dispensing mechanism comprising a coin hopper and an endless conveyor system which raises coins from the base region of the mechanism to an exit point located somewhat above the base of the hopper. This arrangement has been successful but is relatively bulky since the hopper is mounted to one side of the conveyor system so that coins may fall from an inclined bottom of the hopper onto a bight at the bottom of the conveyor loop.

In order to at least partially overcome the above-described problem the invention provides coin handling apparatus comprising a first elongate part and a second elongate part which parts are configured 5 for relative sliding movement and define an elongate coin passage therebetween, said parts being provided with projections at least partially disposed in said coin passage which projections are cooperable such that, in use, reciprocal sliding movement of one of 10 said parts relative to the other said part causes a coin to be transferred along said passage in a stepwise manner.

A further problem associated with coin handling apparatus is the separation of coins held in a coin 15 store such that the number of coins paid out can be reliably controlled. This problem is made worse where coins may have become stuck together due to their being soaked in beer for instance.

GB-A-2135097 discloses a coin apparatus for 20 separating coins from a stack of coins. The apparatus comprises a structure having a container for storing a stack of coins and a coin slide disposed beneath the container and slideable in a direction perpendicular to the axis of the coin stack. The coin slide is 25 provided with an aperture for receiving the endmost coin of the coin stack such that when caused to slide

away from the container the coin is drawn away from the stack. A fixed coin stop is fitted to the container at a predetermined distance above a surface which supports the coin slide and endmost coin. The 5 coin stop has an engaging surface having a height selected so as to permit movement of the endmost coin by the coin slide but detain the coin next to the endmost coin thus ensuring that only one coin is withdrawn on each stroke of the coin slide.

10 The apparatus disclosed in GB-A-2135097 has proved successful. However, it has the disadvantage that the height of the engaging surface is specific to a certain range of coin thickness and therefore if the apparatus is to be converted for use with, for 15 example, a significantly thinner coin, a different coin stop having a coin engaging surface of increased height must be fitted to the container. Typically, therefore, the apparatus is designed with a set of coin stops all identical except for the height of the coin engaging surface. It will be appreciated that it 20 would be convenient not to have to fit different components whenever it is desired to dispense a coin having a thickness different to that the apparatus has previously been set up to handle.

25 In order to overcome, at least partially, the problem described in the last preceding paragraph the

invention provides a coin dispensing apparatus comprising coin receiving means adapted to hold a stack of coins which comprises at least two coins disposed one upon the other, coin engaging means for 5 engaging a circumferential edge portion of an endmost coin of such a stack such that relative movement between said coin receiving means and said coin engaging means causes transverse movement of the coin relative to the stack, and coin stop means moveable so 10 as to permit such transverse movement of such an endmost coin but substantially prevent similar such movement of the coin next to said endmost coin in the stack.

The invention also includes coin dispensing 15 apparatus comprising means defining a coin passage, at least one part having a first position in which it projects at least partially into said passage and being moveable in response to a load imposed by an edge portion of such a coin in transit along said 20 passage and detecting means for detecting movement of the or at least one said part and providing a signal proportional to the amount of said movement whereby the thickness of such a coin causing said movement can be determined.

25 In order that the invention may be well

understood, some embodiments thereof, which are given by way of example only, will now be described with reference to the accompanying drawings, in which:

5       Figure 1 is a schematic sectional side view of a first embodiment of coin handling apparatus;

Figure 2 is a side view of a driven elongate part of the apparatus of Figure 1 with a coin stop mounted thereon;

10      Figure 3 is a top plan view of a portion of Figure 2 showing two coin stops with the elongate part drawn transparent;

Figure 4 is a view from below of the portion of the elongate part shown in Figure 3;

15      Figure 5 is an end view of the apparatus shown in Figure 1;

Figure 6 is a view from below of another portion of Figure 2;

20      Figure 7 is a cut-away schematic orthographic projection of the coin handling apparatus shown in Figure 1;

Figure 8 is a block diagram representing a portion of the drive system for the coin handling apparatus;

25      Figure 9 is a schematic sectional side view of a second embodiment of coin handling apparatus; and

Figures 10 to 16 are schematic sectional side

views illustrating operation of the apparatus shown in Figure 9.

5 The structure of a first embodiment of coin handling apparatus will now be described with reference to Figures 1 to 8. Operation of the coin handling apparatus of the first embodiment will become clear from the detailed description of a second embodiment of the apparatus which will be described with reference to Figures 9 to 16.

10 Referring to Figures 1 to 8, a coin handling apparatus 10 comprises a first elongate part 12 and a second elongate part 14 which are housed in a housing 16. Opposite side walls 18 of the housing are provided with elongate ribs (not shown). Edge 15 portions of the parts 12, 14 are mounted between these ribs. The housing defines a coin store indicated at 20 which has a bottom wall 22 which is inclined such that coins held in the coin store tend to fall towards the part 12.

20 The housing 16 is open at the top 24 to allow coins to be poured into the coin store 20. An end wall 26 of the housing is provided with a coin exit 28 through which coins C can be dispensed to, for example, the payout cup of a gaming machine.

25 The parts 12, 14 are curved in the lengthwise direction thereof and are configured for relative

sliding movement. The part 14 is fixedly held in the housing 16 and the part 12 is mounted so as to be slideable on the part 14. The part 12 is driven by a drive system (described in more detail hereinbelow) which causes reciprocal sliding movement of the part 12 relative to the fixed part 14 as indicated by the arrow D.

The drive system comprises a reversible motor 30 having a small diameter pulley 32 fixed to its drive shaft. A rubber drive belt 34 connects the pulley 32 with a larger diameter pulley 36 which is fixed to the input shaft 38 of an epicyclic gear system 40. A crank 42 having a crank arm 44 is connected with the output side of the epicyclic gear system 40. A needle roller bearing 46 is mounted to the crank arm 44 and engages in a transversely extending drive slot 48 provided in the underside of the driven part 12. A thrust bearing 50 is provided between the parts 12, 14.

When the motor 30 is energised, the driven part 12 is caused to slide back and forth as indicated by the arrow D. In Figure 1 the driven part 12 is shown at the end of its forward (upward) stroke. It will be appreciated that reciprocal sliding movement of the part 12 will be obtained regardless of the direction of rotation of the motor. Thus, by selectively

varying the direction of rotation of the motor, wear on the transmission elements can be evenly distributed. It will also be appreciated that the reduction pulley system 32, 36 and the epicyclic gear system 40 each serve to reduce the drive speed and increase the drive torque delivered to the crank 42. A further advantage obtained by using an epicyclic gear system is that it can be arranged to provide a stable platform for the crank 42.

The elongate parts 12, 14 define a coin passage 52 therebetween which extends in the lengthwise direction of the parts. The driven part 12 has an inlet for coins in the form of an aperture 54 which is communicable with the coin passage 52. The coin passage 52 extends between the inlet 54 and the coin exit 28.

The inlet 54 is arranged such that coins from the coin store 20 can fall into it to form a stack S as shown in Figure 1. Coins will tend to fall into the inlet 54 when the drive part 12 is near the end of its rearward (downward) stroke at which time the inlet is adjacent the free end 55 of the coin store bottom wall 22. It will be appreciated that in practice the coins received in the inlet may not form a neatly ordered stack as shown in Figure 1. In this document the term "stack" is employed to mean two or more coins

generally disposed in face-to-face relationship but not necessarily axially aligned.

A coin pusher member 56 is slideably mounted to the fixed part 14. The coin pusher 56 has a coin engaging face 58 which projects above the upper surface 59 of the fixed part 14 for engaging a circumferential edge portion of an endmost coin C1 of the stack of coins S in the inlet. The coin engaging face 58 is arranged to push such a coin C1 transversely off the stack S during each return stroke of the driven part 12 so that on each return stroke the endmost coin in the stack is pushed out of the inlet 54 into the coin passage 52.

The parts 12, 14 are provided with projections having parts which project into the coin passage 52 and which are cooperable such that reciprocal sliding movement of the driven part 12 relative to the fixed part 14 causes coins to be transferred along the coin passage in a stepwise manner.

The projections provided on the driven part 12 include two catches 60 which are mounted side-by-side on the driven part 12 adjacent the inlet 54 as best seen in Figures 3 and 4. The catches 60 serve to ensure that only the endmost coin C1 is pushed out of the inlet by the coin pusher 56. Each catch 60 is provided with an integral mounting pin 62 which has

its ends fitted in respective pairs of slots 64 provided in the driven part. For each catch 60 there is a biasing spring 66 which has one end fixed in a respective aperture 70 defined in the driven part 12 and its other end fixed to a post 72 on the respective catch. The springs 66 bias their respective catches to a closed position in which transverse movement of coins from the stack S under the influence of the coin pusher 56 is prevented. As will become clear from the 10 description of the operation of the apparatus of the second embodiment which follows, the catches 60 can slide away from the inlet 54 against the biasing force exerted by their springs 66. The slots 64 are arranged such that as the catches 60 slide away from 15 the inlet 54, the endmost coin C1 is permitted to move transversely to the stack S into the coin passage 52 when pushed by the coin pusher, but similar such movement of the next coin C2 in the stack is substantially prevented.

20 The coin pusher 56 is mounted to the fixed part 14 so as to be slideable in the lengthwise direction of the part. A biasing spring 78 extends between an arm 80 provided on the coin pusher 56 and an arm 82 provided on the fixed part 14. The spring 78 biases 25 the coin engaging face 58 towards the inlet 54, that is towards a coin engaging position. The catch

biasing springs 66 and the spring 78 are selected such that under normal operating conditions the coin pusher 56 will maintain a substantially constant position to provide a pushing force on the coin C1 and the catches 60 will slide away from the inlet 54 under the influence of the pushing force. However, if a foreign object which cannot enter the coin passage 52 is encountered, the coin pusher can slide down and away from the inlet 54 against the spring 78 such that the engaging face 58 is below the upper surface 59 of the fixed part 14 to enable the obstruction to clear. The object can then be shaken out of the inlet 54 allowing further coins to be handled. It will be appreciated that the above-described sliding movement of the spring loaded coin pusher 56 will prevent shock loads being transmitted to the epicyclic gear system 40 should such a jam occur. The drive system includes a current sensing device 80 which senses an abnormal load on the motor and a control unit 82, which includes a microprocessor 84, is provided which can cause reversal of the drive direction to prevent the occurrence of jams.

It is envisaged that very occasionally during use of the apparatus 10, an abnormally large stack of coins may build-up which would place the drive system under a potentially damaging load or even cause the

apparatus to jam. By reversing the motor direction if a load exceeding a predetermined amount is detected, it should be possible to ensure that the coins disposed above the driven part 12 are shaken about 5 thereby preventing the formation of large stacks of coins and thus the occurrence of jams.

The control unit 82 is preferably connected with a position sensor 86 which monitors the position of the driven part 12. By this means it is possible to 10 ensure that the driven part 12 is stopped at a desired position at the end of each coin dispensing operation. The sensor 86 also allows the number of cycles of the driven part to be determined and this information can be used to monitor the number of coins dispensed by 15 the apparatus 10.

The projections further comprise catches in the form of detents 96 provided on both the driven and fixed part. As shown in Figure 6 the driven part has two detents 96 which are disposed side-by-side. These 20 detents are aligned with the catches 60. The fixed part 14 has two centrally disposed detents, the arrangement being such that there is no interference between detents and catches on the two parts as the driven part slides back and forth.

25 The detents 96 are integral with their respective parts 12, 14 and each comprise a resilient hinge arm

98 defined by a generally U-shaped slot 100 which penetrates the respective part and a tip at the free end of the hinge arm which tip has a ramp face 102 and a pushing face 104. The detents 96 are deflectable transversely of their respective parts so as to reduce the extent to which their tips project into the coin passage 52.

The operation of the apparatus 10 will become clear from the description which follows of the 10 operation of a second embodiment of coin handling apparatus. The coin handling apparatus 200 of the second embodiment is generally similar to the apparatus 10. Accordingly, in the description and drawings relating to the second embodiment, the same 15 reference numerals are used to designate like or similar parts.

Referring to Figures 9 to 16, the coin handling apparatus 200 comprises a first elongate part 12 and a second elongate part 14 which parts are configured for relative sliding movement and define a coin 20 passage 52 therebetween. The elongate parts 12, 14 of the second embodiment differ from the elongate parts of the first embodiment in that they do not curve in the lengthwise direction thereof. The part 12 is 25 driven so as to slide back and forth on the part 14 which is fixed.

The elongate parts 12, 14 are mounted in a housing 16 which has a coin exit 28. The housing 16 defines a coin store 20 having a bottom wall 22 which is inclined such that coins held in the coin store 5 tend to fall towards the part 12.

A drive system for driving the part 12 comprises a reversible motor 30 which drives a crank (not shown) for causing reciprocal sliding movement of the elongate part 12. The complete drive system has not 10 been shown in Figure 9 to improve the clarity of the drawing. The skilled person will appreciate that the drive system may comprise a belt and pulley arrangement and an epicyclic gear system similar to that shown in Figure 1. Alternatively, the motor 30 15 of either embodiment could be connected with the crank directly via an arrangement of gears.

As in the first embodiment, the driven part has an inlet defined by an aperture 54 which leads to the coin passage 52. Likewise the driven part has 20 projections in the form of two slideable catches 60 mounted adjacent the inlet 54 and the fixed part has a slideable coin pusher 56 mounted thereon.

The parts 12, 14 have projections which include 25 detents 96. The driven part has two sets of detents 96(1), 96(2) arranged in side-by-side relationship which sets are spaced apart in the lengthwise

direction of the part. The fixed part has a centrally disposed row of three detents 96(3), 96(4), 96(5).

Referring to Figure 10 which shows the driven part 12 at the end of its forward stroke, it will be seen that the projection means 60, 96 define a plurality of coin receiving compartments 110(1), 110(2) in the coin passage 52. It will be appreciated that further detents 96 can be provided on the parts 12, 14 so that a plurality of compartments 110(1) to 110(N) is provided between the inlet 54 and the exit end of the coin passage 52. Thus a row of compartments 110 can be provided which extend between the inlet 54 and the coin exit 28 so that as the driven part 12 slides back and forth a coin can be transferred along the coin passage in a stepwise manner from compartment to compartment.

At the end of a coin dispensing operation, the driven and fixed parts 12, 14 are disposed as shown in Figure 10 with the driven part at the end of its forward stroke. Coins from the coin store 20 have fallen into and filled the inlet 54 forming a stack S of coins.

In order to dispense a coin, the motor 30 is energised to cause reciprocating movement of the driven part 12 which commences its rearward stroke moving away from the coin exit 28. In Figures 10 to

16 the direction of movement of the driven part is indicated by an arrow d. As the driven part 12 moves back, coins in the stack S come into contact with the catches 60 as shown in Figure 11. Only the endmost 5 coin C1 of the stack S is engaged by the engaging face 58 of the coin pusher 56. As the driven part continues to move back the coin pusher 56 pushes the coin C1 against the catches 60 which are forced to slide backwards and upwards guided by the engagement of their mounting pins 62 in the slots 64. This 10 allows the tips 112 of the catches to ride over the coin C1 thereby gradually separating this coin from the next coin C2 in the stack. The coin separation process is just commencing when the parts 12, 14 are 15 in the position shown in Figure 12. Referring to Figure 13, as the driven part continues to move back the catch tips 112 slide along the top of the coin C1. It will be appreciated that the catches 60 will reliably separate the coin C1 from the coin C2 even if 20 the coins are sticky or damp.

In Figure 14 the driven part 12 is shown at the end of its rearward stroke. In this position the catches 60 have cleared the coin C1 which is completely separated from the stack S. The catches 60 25 are pulled back towards the lower end of their slots 64 by the biasing springs 66 such that their tips 112

fall behind the coin C1. The driven part now changes direction and commences its forward stroke. As the part 12 moves forward the catch tips 112 engage the coin C1 which is pulled forwards into the coin passage 52 against the ramped face 102(3) of the detent 96(3). The pushing force of the leading edge of the coin C1 acting against the ramped face 102(3) of the detent 96(3) causes the detent to deflect transversely of the part 14 away from the driven part 12 as shown in 10 Figure 15 thereby allowing the coin C1 to pass over the detent.

In Figure 16 the driven part is shown returned to its most forward position. In this position, the coin C1 is disposed in the first coin receiving compartment 15 110(1) so that the coin C2 is now the endmost coin in the stack S.

Referring back to Figure 10, the transfer of a coin C3 from the first coin receiving compartment 110(1) to the next adjacent coin receiving compartment 110(2) will now be described. It will be appreciated that this transfer of the coin C3 takes place simultaneously with the transfer of the coin C1 from the inlet 54 to the first coin receiving compartment 20 110(1).

25 As the driven part 12 moves back from the position shown in Figure 10, the rearward facing

portion of the circumferential edge of the coin C3 is engaged by the pushing face 104(3) of the detent 96(3) as shown in Figure 11. This causes the coin C3 to be pushed towards and into engagement with the ramp face 102(1) of the detent 96(1) on the driven part 12 which in turn causes the detent 96(1) to deflect transversely of the coin passage 52 and away from the fixed part 14 so that the detent 96(1) passes over the coin as the driven part continues on its rearward stroke. At the end of the rearward stroke the pushing face 104(3) of the detent 96(3) is behind the coin C3 and the detent 96(1) has resumed its normal non-deflected condition as shown in Figure 14.

Referring to Figure 15, as the driven part 12 moves toward the coin exit 28 on its forward stroke, the pushing face 104(1) of the detent 96(1) engages behind the coin C3 pushing it against the ramp face 102(4) of the detent 96(4) which is caused to deflect transversely of the fixed part 14 and away from the driven part 12. With the detent 96(4) deflected in this way, the coin C3 is pushed forwards over the detent 96(4) so that when the forward stroke of the driven part is complete, the coin C3 is disposed in the compartment 110(2) in the coin passage 52 as shown in Figure 16.

It will be appreciated that driving the driven

part through two forward and return strokes will have caused the coin C3 to be transferred along the coin passage 52 in a stepwise manner. The first step occurs during the first cycle of the driven part and involves the transfer of the coin C3 from the inlet 54 to the compartment 110(1) and the second step occurs during the second cycle of the driven part and involves the transfer of the coin C3 from the compartment 110(1) to the compartment 110(2).

It will be understood that the coin handling apparatus 10 and 200 both permit the transfer of coins in an upward direction and that both structures can readily be adapted to transfer coins over a required distance by modifying the length of the elongate parts to suit the desired transfer distance and increasing or decreasing the number of detents 96 so that coins can be transferred stepwise along the length of the elongate parts.

It is envisaged that curved parts 12, 14 may be used together with straight parts 12, 14 connected in series to provide the potential of very long coin transfer paths. It will be appreciated that a flexible coupling between the curved and straight parts would be required.

With reference to Figure 5, it will be appreciated that the coin handling apparatus of the

embodiments can be made compact. The housing for the elongate parts need only be slightly wider than the elongate parts which preferably are mounted directly to the side walls of the housing; it will be  
5 appreciated that the elongate parts need only be a relatively small amount wider than the diameter of the largest coin which the apparatus is intended to handle. Furthermore, since for many uses, the elongate parts will be used to transfer coins from a  
10 lower level to a higher level, it is possible to position the drive system in what would otherwise effectively be a lost space beneath the elongate parts in the housing.

15 Although the coin handling apparatus of the embodiments has been described as being used for transferring coins upwardly, it will be appreciated that the apparatus is equally suitable for transferring coins horizontally and it is envisaged that downward transfer could also be obtained.

20 It will also be understood that although the coin store of the embodiments is a hopper, a coin tube may be used instead.

25 It will also be understood that the apparatus permits coins from a coin store to be reliably separated one from the other and dispensed one by one and that the number of coins dispensed can readily be

monitored.

If the coin store is a hopper, the number of coins dispensed is preferably monitored by means of a sensor device positioned adjacent the coin exit 28 so as to detect coins passing through the last coin receiving compartment or through the coin exit 28. However, it will be appreciated that means may be provided for detecting coins entering the first coin receiving compartment from the inlet or the presence of a coin in a compartment disposed intermediate the inlet and the coin exit 28. It will be understood that in an arrangement in which the presence of a coin is detected in the first coin receiving compartment or a compartment intermediate the first and last coin receiving compartments, the number of coins dispensed can be controlled by operating the apparatus through the number of cycles required in order to move the coin from the detected position to the coin exit.

Alternatively, the number of revolutions of the motor could be monitored or a position sensor could be used to detect movement of the driven part to count the number of strokes completed. A further alternative would be to energise the motor for a predetermined period of time to drive the driven part through a predetermined number of strokes.

It will be appreciated that if a hopper is used,

there may be occasions on which a coin is not moved into the first coin receiving compartment during a cycle of the apparatus and thus there may be occasions on which a coin is not dispensed through the coin exit 5 although a cycle of the apparatus has been completed. However, if a coin tube is used, a coin will be reliably moved into the coin passage on each cycle of the apparatus and thus each coin receiving compartment should always have a coin disposed therein (the 10 skilled person will be aware of the use of sensing means in association with the coin stack by means of which it can be determined when the coin tube will be empty of coins) and the number of coins dispensed can be reliably monitored by, for example, counting the 15 cycles of the driven part, the revolutions of the motor or by energising the motor for a predetermined period of time to drive the driven part through a predetermined number of strokes.

A further advantage of the coin handling 20 apparatus is that the moveable coin stops allow the handling of coins of varying thicknesses (the limit being the height of the coin passage) without any modifications to the apparatus. Thus, for example, even if the coin store holds a mixture of coins having 25 different thicknesses it can be ensured that the coins will be reliably separated since the coin stops will

only move a sufficient distance to allow the endmost coin of the stack to pass regardless of its thickness.

It is envisaged that the coin handling apparatus may be provided with means for monitoring the thickness of coins passing through the coin passage. Thus, if the apparatus is used to handle coins of varying thickness, the denomination of each coin dispensed could be ascertained by reference to its thickness. The monitoring means may comprise means for monitoring the degree of lift or backward movement of the catches mounted adjacent the coin inlet. Alternatively, the degree of tension in the catch biasing springs would be monitored. A further alternative would be to monitor the amount of movement of the detents. It is envisaged that a linear variable differential transformer (LVDT) would be one suitable transducer for use in monitoring the movement of the catches or detents. An LVDT 202 is shown schematically in Figure 9 arranged for use in detecting the amount of movement of a catch 60.

Yet another advantage of the coin handling apparatus of the embodiments is that the separation and transfer process can be obtained by driving only one part. Movement of the other moving parts in the apparatus is generated by a load imposed by a coin which load is generated by the movement of the driven

part. In moving along the coin passage, at each step a coin moves past one projection on the driven part and one projection on the fixed part and in each case is pushed forward over the next adjacent projection by 5 the projection over which it has most recently passed.

CLAIMS:

1. Coin handling apparatus comprising a first elongate part and a second elongate part which parts are configured for relative sliding movement and define an elongate coin passage therebetween, said parts being provided with projections at least partially disposed in said coin passage which projections are cooperable such that, in use, sliding movement of one of said parts relative to the other said part causes a coin to be transferred along said passage in a stepwise manner.  
5
2. Apparatus as claimed in claim 1, wherein said projections define a plurality of coin receiving compartments in said coin passage which compartments are spaced apart in the lengthwise direction of said parts, the arrangement being such that said relative sliding movement causes a coin received in a said compartment to be transferred to the next adjacent compartment.  
15
3. Apparatus as claimed in claim 1 or 2, wherein one of said parts is adapted to be driven by a drive system for causing reciprocal sliding movement of said driven part relative to the other said part.  
20

4. Apparatus as claimed in claim 3, further comprising a drive system connectable with said driven part for causing said reciprocal sliding movement.

5. Apparatus as claimed in claim 4, wherein said drive system comprises a reversible motor.

6. Apparatus as claimed in claim 4 or 5, wherein said drive system includes an epicyclic gear system.

7. Apparatus as claimed in claim 4, 5 or 6, wherein said drive system includes a crank having a crank arm engageable in a drive slot defined by said driven part.

8. Apparatus as claimed in any one of the preceding claims, wherein said projections provided on at least one of said parts comprises a plurality of catches deflectable transversely of the respective part.

9. Apparatus as claimed in claim 8, wherein at least one of said catches is integral with the said part on which it is provided.

10. Apparatus as claimed in any one of the preceding claims, wherein one of said parts is provided with an

aperture which at least partially defines an inlet to said coin passage.

11. Apparatus as claimed in claim 12, wherein said inlet is adapted for holding a stack of coins.

5       12. Apparatus as claimed in claim 11, wherein the other of said parts comprises coin engaging means for engaging a circumferential edge portion of an endmost coin of such a stack to cause transverse movement of the coin relative to the stack for transferring such  
10       an endmost coin into said coin passage.

15       13. Apparatus as claimed in claim 12, wherein the said projections of the one of said parts provided with said inlet aperture comprise coin stop means deflectable from a closed position to permit said transverse movement of such an endmost coin and prevent similar such movement of the coin next to said endmost coin.

20       14. Apparatus as claimed in claim 13, wherein said coin stop means comprises at least one catch mounted on the part provided with said inlet aperture and biasing means for biasing the or each catch towards said closed position.

15. Apparatus as claimed in claim 14, wherein the or each catch is slidably mounted to said part so as to be slideable away from said inlet aperture against a biasing force provided by said biasing means.

5 16. Apparatus as claimed in any one of claims 12 to 15, wherein said coin engaging means comprises a member slidably mounted to said other part, said member being biased towards a coin engaging position.

10 17. Apparatus as claimed in any one of claims 11 to 16, further comprising housing means for said first and second parts, said housing means defining a coin store arranged for feeding coins to said inlet.

15 18. Apparatus as claimed in claim 17, wherein said housing means is provided with a coin exit and said first and second parts are arranged in said housing means for transferring coins upwardly from said inlet to said coin exit.

20 19. Apparatus as claimed in claim 17 or 18, when dependent on a claim dependent on claim 4, wherein said drive system is disposed in said housing means beneath said first and second parts.

20. Apparatus as claimed in claim 17, 18 or 19, wherein the width of said housing means is substantially the same as the width of said first and second parts.

5 21. Apparatus as claimed in any one of the preceding claims, wherein in the lengthwise direction thereof said first and second parts are curved.

10 22. Apparatus as claimed in any one of the preceding claims, further means for detecting movement of one or more of said projections, said detecting means providing a signal related to said movement whereby the thickness of coin causing said movement can be determined.

15 23. Coin dispensing apparatus comprising coin receiving means adapted to hold a stack of coins which comprises at least two coins disposed one upon the other, coin engaging means for engaging a circumferential edge portion of an endmost coin of such a stack such that relative movement between said coin receiving means and said coin engaging means causes transverse movement of the coin relative to the stack, and coin stop means moveable so as to permit such transverse movement of such an endmost coin but

substantially prevent similar such movement of the coin next to said endmost coin in the stack.

24. Apparatus as claimed in claim 23, wherein said coin stop means is deflectable in response to a load  
5 imposed by such a transversely moving endmost coin.

25. Apparatus as claimed in claim 23 or 24, wherein said coin stop means is adapted for sliding movement in a direction transverse to the plane of such an endmost coin.

10 26. Apparatus as claimed in claim 23, 24 or 25, further comprising biasing means for opposing movement of said coin stop means.

15 27. Apparatus as claimed in any one of claims 23 to 26, wherein said coin receiving means comprises a hopper.

28. Apparatus as claimed in any one of claims 23 to 27, wherein said relative movement is obtained by causing reciprocal sliding movement of one of said coin receiving means and coin engaging means.

20 29. Apparatus as claimed in any one of claims 23 to

28, further comprising detecting means for detecting the amount of movement of said coin stop means.

30. Apparatus as claimed in claim 29, wherein said detecting means provides a signal proportional to the amount of such movement and further comprising means for receiving said signal and determining the thickness of such an endmost coin according to said signal.

31. Apparatus as claimed in claim 29 or 30, wherein said detecting means comprises at least one linear variable differential transformer.

32. Coin dispensing apparatus comprising means defining a coin passage, at least one part having a first position in which it projects at least partially into said passage and being moveable in response to a load imposed by an edge portion of such a coin in transit along said passage and detecting means for detecting movement of the or at least one said part and providing a signal proportional to the amount of said movement whereby the thickness of such a coin causing said movement can be determined.

33. Apparatus as claimed in claim 32, wherein the or

at least one said part is biassed to said first position for preventing movement of coins along said coin passage and is moveable in response to such a load imposed by an edge portion of such a coin to 5 permit movement of the coin along the coin passage.

34. Apparatus as claimed in claim 32 or 33, wherein said passage defining means comprises two elongate parts arranged to define said coin passage therebetween, said elongate parts being configured for 10 relative sliding movement.

35. Apparatus as claimed in claim 32, 33 or 34, wherein said detecting means comprises at least one linear variable differential transformer.

36. Coin handling apparatus substantially as 15 hereinbefore described with reference to Figures 1 to 8 or 9 to 16 of the drawings.



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Application No: GB 9612452.4  
Claims searched: 1 to 22

Examiner: Mr. G. Nicholls  
Date of search: 12 August 1996

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): G4V (VAE VAG) G4X (X3 X5) B8A (A6F) B8U (UGA)

Int Cl (Ed.6): G07D 1/00 1/02 1/04 1/06

Other: ONLINE:WPI

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
X	GB 1340028 (KULBENKO) See especially Figure 3	1 to 4, 8

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.